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Latent Volatility Granger Causality and Spillovers in Renewable Energy and Crude Oil ETFs

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Abstract

The purpose of the paper is to examine latent volatility Granger causality for four renewable energy Exchange Traded Funds (ETFs) and crude oil ETF (USO), namely solar (TAN), wind (FAN), water (PIO), and nuclear (NLR). Data on the renewable energy and crude oil ETFs are from 18 June 2008 to 20 March 2017. From the underlying stochastic process of a vector random coefficient autoregressive (VRCAR) process for the shocks of returns, we derive Latent Volatility Granger causality from the Diagonal BEKK multivariate conditional volatility model. We follow Chang et al. (2015)'s definition of the co-volatility spillovers of shocks, which calculate the delayed effect of a returns shock in one asset on the subsequent volatility or co-volatility in another asset, and extend the effects of the co-volatility spillovers of shocks to the effects of the co-volatility spillovers of squared shocks. The empirical results show there are significant positive latent volatility Granger causality relationships between solar (TAN), wind (FAN), nuclear (NLR), and crude oil (USO) ETFs, specifically significant volatility spillovers of shocks from solar ETF on the subsequent wind ETF co-volatility with solar ETF, and wind ETF on the subsequent solar ETF co-volatility with wind ETF. Interestingly, there are significant volatility spillovers of squared shocks for the renewable energy ETFs, but not with crude oil ETFs.

Keywords Renewable Energy, Latent Volatility, Granger Causality, Co-volatility Spillovers, Solar, Wind, Water, Nuclear Power.

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